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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/774,522	02/10/2004	Kenji Yoneda	60188-768	9901

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EXAMINER	
SARKAR, ASOK K	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 08/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/774,522	YONEDA, KENJI	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) *4 and 20-23* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 5-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/04 and 8/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I, Species I claims 1 – 3 and 5 – 19 in the reply filed on July 20, 2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

2. Claims 4 and 20 – 23 were withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Species II and Group II claims, there being no allowable generic or linking claim. Election was treated as being made **without** traverse in the reply filed on July 20, 2005.

Drawings

3. Figures 8A – 8E should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 3, 6 and 8 – 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted Prior Art (APA) in view of Kamimura, JP 08085341 and Kraus, US 6,660,659.

Regarding claims 1 and 3, the APA teaches a method for fabricating a semiconductor device, comprising the steps of:

- removing part of a first oxide film formed on a surface of a semiconductor substrate;

- forming a second oxide film, in part of the semiconductor substrate from which the first oxide film has been removed in between page 1, line 20 and Page 2, line 3.

The APA also teaches that various methods of forming gate insulating films have been examined in page 2, lines 3 – 8.

The APA fails to teach (1) using a solution including an oxidizer and (2) making each of the first and second oxide films into an oxynitride film by exposing the first and second oxide films to a plasma having an electron energy of 5 eV or less and containing nitrogen.

Regarding element (1), Kamimura teaches forming gate oxide with a solution oxidizer for the benefit of forming a thin gate oxide film in the English abstract of the disclosure.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and form the gate oxide with a solution oxidizer for the benefit of forming a thin gate oxide film as taught by Kamimura in the English abstract of the disclosure.

Regarding element (2), Kraus teaches a method of forming oxide film into an oxynitride film by exposing oxide films to a plasma having an electron energy of 5 eV or less and containing nitrogen in column 4, lines 36 – 47 and with reference to Fig. 3 in between column 3, line 56 and column 4, line 14 for the benefit of incorporating nitrogen in the oxide film without damaging the oxide layer in column 1, lines 28 – 37. The

electron energy of 5 eV or less in inherent in plasma with electron temperature of less than 2 eV as taught by Kraus in column 4, lines 45 – 47.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and form the oxide film into an oxynitride film by exposing oxide films to a plasma having an electron energy of 5 eV or less for the benefit of incorporating nitrogen in the oxide film without damaging the oxide layer as taught by Kraus in column 1, lines 28 – 37.

Regarding claim 6, the APA teaches forming the first oxide by thermal oxidation in page 1, lines 23 – 25.

Regarding claims 8 and 9, Kraus teaches a plasma nitridation process wherein the ion density of the plasma is not less than 5×10^{9} cm^{-3} and not more than 1×10^{12} cm^{-3} in column 4, lines 45 – 47 for the benefit of incorporating nitrogen in the oxide film without damaging the oxide layer in column 1, lines 28 – 37.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and form the oxide film into an oxynitride film by a plasma nitridation process wherein the ion density of the plasma is not less than 5×10^{9} cm^{-3} and not more than 1×10^{12} cm^{-3} for the benefit of incorporating nitrogen in the oxide film without damaging the oxide layer in column 1, lines 28 – 37.

Regarding claims 10 and 11, Kraus teaches a plasma nitridation process wherein the temperature of the plasma is inherently between 0°C and 500°C since the electron temperature is less than 2eV.

Regarding claims 12 and 13, Kraus teaches a plasma nitridation process wherein the plasma is inductively coupled in column 2, line 63.

7. Claims 2, 5, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted Prior Art (APA) in view of Kamimura, JP 08085341 and Kraus, US 6,660,659 as applied to claims 1 and 3 above, and further in view of Aronowitz, US 6,003,998.

Regarding claims 2 and 5, the APA in view of Kamimura and Kraus fails to teach method for fabricating a semiconductor device comprising, before the step of forming an oxide film, the step of forming an isolation region using STI process and forming gate dielectric of variable thickness.

Aronowitz teaches method for fabricating a semiconductor device comprising, before the step of forming an oxide film, the step of forming an isolation region using STI process and gate dielectric of variable thickness with references to Figs. 2A – 2F for the benefit of forming digital and analog devices in the same IC circuit in column 3, lines 47 – 50.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and form a thinner second gate oxide on a substrate with STI for the benefit of forming digital and analog devices in the same IC circuit as taught by Aronowitz in column 3, lines 47 – 50.

Regarding claims 16 and 17, the APA in view of Kamimura and Kraus fails to teach after the step of making the oxide film into an oxynitride film, the step of

performing thermal treatment to the semiconductor substrate in an atmosphere containing oxygen.

Aronowitz teaches method for fabricating a semiconductor device comprising the step of after making the oxide film into an oxynitride film, the step of performing thermal treatment to the semiconductor substrate in an atmosphere containing oxygen in between column 6, line 61 and column 7, line 6 and grow different oxide thickness for the benefit of forming digital and analog devices in the same IC circuit in column 3, lines 47 – 50.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and perform the step of after making the oxide film into an oxynitride film, the step of performing thermal treatment to the semiconductor substrate in an atmosphere containing oxygen and grow different oxide thickness for the benefit of forming digital and analog devices in the same IC circuit as taught by Aronowitz in column 3, lines 47 – 50.

8. Claims 7, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted Prior Art (APA) in view of Kamimura, JP 08085341 and Kraus, US 6,660,659 as applied to claims 1 and 3 above, and further in view of Kusumoto, US 5, 940,690.

Regarding these claims, the APA in view of Kamimura and Kraus fails to teach forming the oxide film with perchloric or nitric acid.

Kusumoto teaches oxidixing agents such as a mixture of perchloric andr nitric acid as an equivalent process of the thermal oxidation in column 2, line 65 and column 3, line 9.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify the APA and form the oxide film with perchloric or nitric acid since thermal oxidation and solution oxidation are equivalent oxidation methods known in the art as taught by Kusumoto in column 2, line 65 and column 3, line 9.

9. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted Prior Art (APA) in view of Kamimura, JP 08085341 and Kraus, US 6,660,659 and Aronowitz, US 6,003,998 as applied to claims 16 and 17 above, and further in view of Hou, US 6,890,811.

Aronowitz teaches thermal oxidation, but fails to teach RTA process with time and temperature.

Hou teaches a RTP wherein in the step of performing thermal treatment, a process temperature is between 800 – 1100°C and a process time is not less than 10 seconds and not more than 120 seconds in column 5, lines 50 – 60 for the benefit of improving leakage current for the grown oxide.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Aronowitz and form the oxide with a RTA process for the benefit of improving leakage current for the grown oxide as taught by Hou in column 5, lines 50 – 60.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

11. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok Kumar Sarkar
Asok K. Sarkar
August 2, 2005

Primary Examiner